UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **9702/53**

Paper 5 Planning, Analysis and Evaluation **October/November 2011**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **8** printed pages.

1 A changing e.m.f. in a coil can induce an e.m.f. in another coil.

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Fig. 1.1 shows a coil (coil X), which is wound on a cardboard tube.

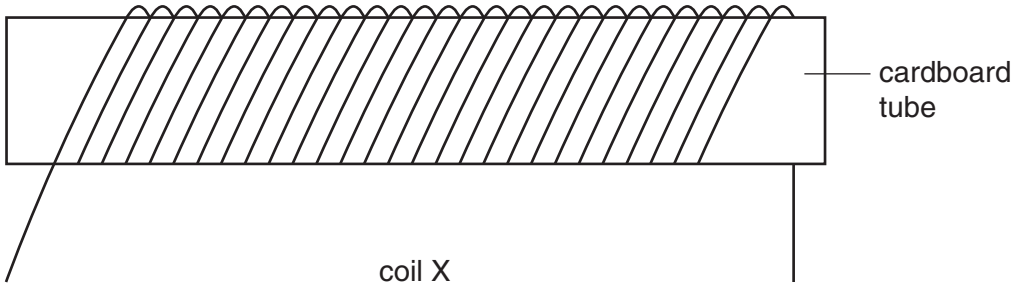

Fig. 1.1

Coil X has cross-sectional area *A*.

A student winds another coil (coil Y) tightly around coil X. The student wishes to investigate how the e.m.f. *V* in coil Y depends on *A*.

It is suggested that *V* is directly proportional to *A*.

Design a laboratory experiment to investigate the suggested relationship. You should draw, on page 3, a diagram showing the arrangement of your equipment. In your account you should pay particular attention to

(a) the procedure to be followed,

(b) the measurements to be taken,

(c) the control of variables,

(d) the analysis of the data,

(e) the safety precautions to be taken.

[15]

Diagram

For Examiner's Use

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For Examiner's Use

For Examiner's Use	Defining the problem	Methods of data collection	Method of analysis	Safety considerations	Additional detail

2 A student is investigating how a mass attached to a trolley affects the motion of the trolley.

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The trolley is attached to a mass m by a string, passing over a pulley, as shown in Fig. 2.1.

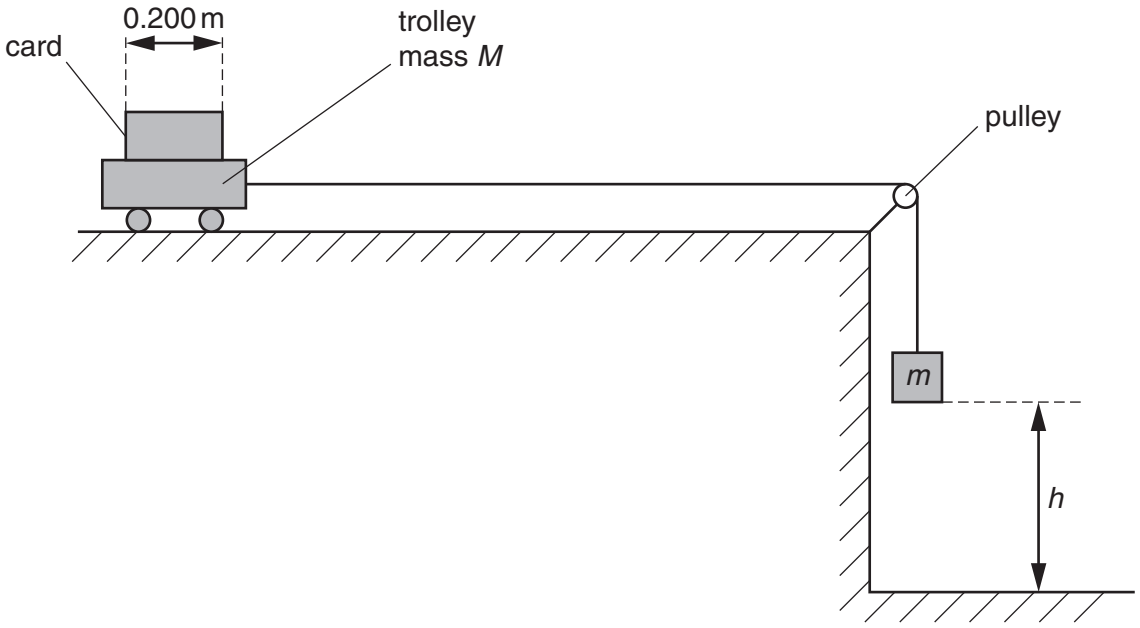

Fig. 2.1

A piece of card of length 0.200 m is fixed to the trolley. The mass M of the trolley and card is 0.800 kg.

The mass m is released and falls through a fixed height h, accelerating the trolley. When the mass m hits the ground, the trolley continues to move with constant velocity v.

This velocity v is determined by measuring the time t for the card to pass fully through a light gate connected to a timer.

Question 2 continues on the next page.

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It is suggested that v and m are related by the equation

$$mg = (m + M)\frac{v^2}{2h}$$

where g is the acceleration of free fall.

(a) A graph is plotted of v^2 on the y-axis against $\frac{m}{m+M}$ on the x-axis. Express the gradient in terms of g.

gradient = ... [1]

(b) Values of m and t are given in Fig. 2.2.

m / kg	t / 10^{-3} s	$\frac{m}{m+M}$	v / m s^{-1}	v^2 / m^2 s^{-2}
0.100	174 ± 2			
0.200	132 ± 2			
0.300	112 ± 2			
0.400	102 ± 2			
0.500	95 ± 2			
0.600	90 ± 2			

Fig. 2.2

Calculate and record values of $\frac{m}{m+M}$, v and v^2 in Fig. 2.2. Include the absolute uncertainties in v^2. [3]

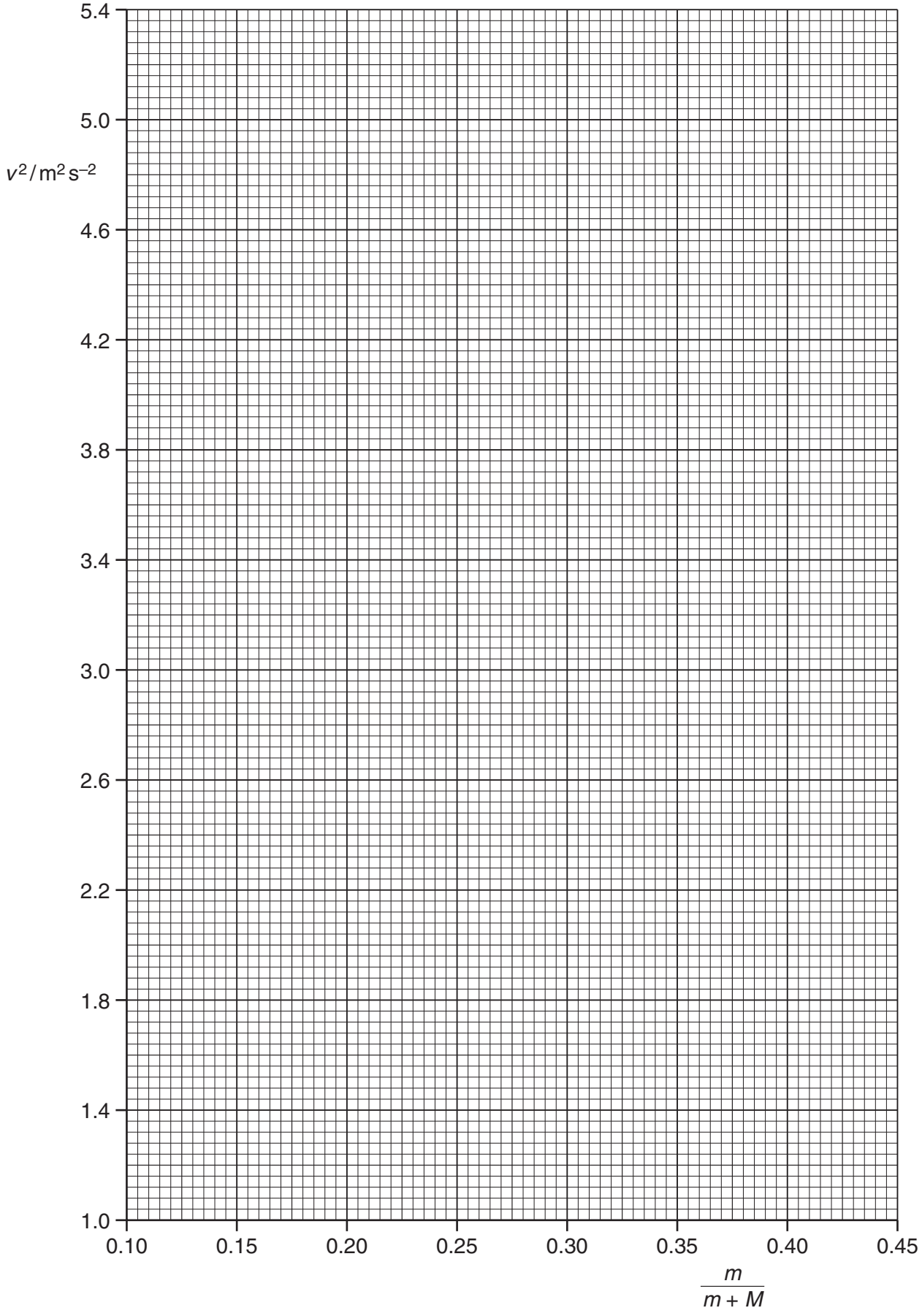
(c) **(i)** Plot a graph of v^2 / m^2 s^{-2} against $\frac{m}{m+M}$. Include error bars for v^2. [2]

(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Both lines should be clearly labelled. [2]

(iii) Determine the gradient of the line of best fit. Include the uncertainty in your answer.

gradient = ... [2]

For Examiner's Use



(d) In this experiment $h = 0.600\,\text{m}$. Using your answer to **(c)(iii)**, determine the value of g. Include the absolute uncertainty in your value.

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$g =$ ..... m s^{-2} [2]

(e) A 1.00 kg mass is added to the trolley and the experiment is repeated using the same range of values of m as in **(b)**.

Determine the **largest** possible value of v that the trolley will gain, using the relationship given and your answer to **(d)**. Include the absolute uncertainty in your answer.

$v =$ ..... m s^{-1} [3]